

APPLICATION SERIAL NO. 10/611,447

PATENT

AMENDMENTS TO THE CLAIMS

Kindly amend claims 1, 2 and 89, cancel claims 41-88 and 96-99 (claims 32-40 and 93-94 having been previously cancelled), and add new claims 100-116 as shown in the following listing of claims, which will replace all prior versions and listings of claims in the application.

Listing of Claims

Claim 1 (currently amended): A light-activated semiconductor switch device for activation by light of a predetermined wavelength, comprising [[:]] a semiconductor switch comprising:

a first n-doped layer and layer;

a first p-doped layer forming a switch blocking junction where in contact with the first n-doped layer, a switch axis lying perpendicular to the switch blocking junction; and [.,]

a groove having a light refracting side wall extending into the first n-doped layer from a side of the n-doped layer opposite from the switch blocking junction, at least a portion of the light refracting side wall being disposed non-parallel to the switch axis;

wherein the first n-doped layer and the first p-doped layer substantially lie within an absorption depth from the groove, the first n-doped layer and the first p-doped layer comprising a material having a band gap and the absorption depth being a function of the band gap and the wavelength of the light.

Claim 2 (currently amended): A device as recited in claim 1, wherein the switch device is a diode, and comprising a first electrode layer disposed over the first n-doped layer and a second electrode layer disposed over the first p-doped layer.

APPLICATION SERIAL NO. 10/611,447

PATENT

Claim 3 (original): A device as recited in claim 2, wherein the switch device is a p-i-n diode and the first n-doped layer comprises an n-drift portion forming the junction with the first p-doped layer and comprises an n-buffer layer between n-drift portion and the first electrode layer.

Claim 4 (original): A device as recited in claim 1, wherein the switch device is a thyristor, the first p-doped layer being a p-base layer, and the first n-doped layer being an n-drift layer, and further comprising a semiconductor anode layer disposed on a side of the n-drift layer away from the switch blocking junction and a semiconductor cathode layer disposed on a side of the p-base layer away from the switch blocking junction.

Claim 5 (original): A device as recited in claim 4, wherein the semiconductor anode layer has no edges forming the side wall of the groove.

Claim 6 (original): A device as recited in claim 4, wherein the n-drift layer extends between the semiconductor anode layer and the side wall of the groove.

Claim 7 (original): A device as recited in claim 4, wherein the n-drift layer includes an n-buffer layer.

Claim 8 (original): A device as recited in claim 7, wherein the n-drift layer extends between the n-buffer layer and the side wall of the groove.

Claim 9 (original): A device as recited in claim 7, wherein the semiconductor anode layer has no edges forming the side wall of the groove.

Claim 10 (original): A device as recited in claim 9, wherein the n-drift layer extends between the n-buffer layer and the side wall of the groove.

Claim 11 (original): A device as recited in claim 4, wherein the n-drift layer extends between the semiconductor anode layer and the groove wall.

APPLICATION SERIAL NO. 10/611,447

PATENT

Claim 12 (original): A device as recited in claim 1, wherein the first n-doped layer comprises a high n-doped region and a low n-doped region between the high n-doped region and the first p-doped region, the switch blocking junction being formed between the low n-doped region and the first p-doped region, the low n-doped region extending between the high n-doped region and the groove.

Claim 13 (original): A device as recited in claim 1, further comprising a light source disposed to direct light into the switch via the groove.

Claim 14 (original): A device as recited in claim 13, wherein the light source comprises a light guide to couple light from the light source into the switch.

Claim 15 (original): A device as recited in claim 14, wherein the light guide is disposed within the groove.

Claim 16 (original): A device as recited in claim 13, wherein the light source is mounted to a plate positioned proximate the switch so as to illuminate the groove.

Claim 17 (original): A device as recited in claim 16, wherein the groove enters the switch from a first side and the light source is disposed to the first side of the switch, wherein the light entering the switch from the light source is refracted at the side wall.

Claim 18 (original): A device as recited in claim 17, wherein the switch comprises a window to permit light entering a second side of the switch opposing the first side to reflect light at the groove side wall.

Claim 19 (original): A device as recited in claim 13, further comprising a plate disposed above the groove to reflect light from the light source to the semiconductor switch.

APPLICATION SERIAL NO. 10/611,447

PATENT

Claim 20 (original): A device as recited in claim 19, wherein the plate comprises an electrically conducting material in electrical contact with an electrode of the semiconductor switch.

Claim 21 (original): A device as recited in claim 19, wherein a lower surface of the plate facing the semiconductor switch contains a recess, the light source being at least partially contained within the recess.

Claim 22 (original): A device as recited in claim 1, wherein the groove extends from the first n-doped layer into the first p-doped layer.

Claim 23 (original): A device as recited in claim 1, wherein the groove is a V-groove.

Claim 24 (original): A device as recited in claim 1, wherein the groove has sloped side walls and has a flat bottom portion.

Claim 25 (original): A device as recited in claim 1, wherein the groove has sloped side walls and a rounded bottom portion.

Claim 26 (original): A device as recited in claim 1, wherein the groove has first and second sloped walls, the first sloped wall forming a first angle with the switch axis and the second sloped wall forming a second angle with the switch axis, a magnitude of the first angle being different from a magnitude of the second angle.

Claim 27 (original): A device as recited in claim 1, wherein the side wall lies at an angle relative to the switch axis of between 10° and 45°.

Claim 28 (original): A device as recited in claim 1, further comprising a unit to generate light having an optical output coupled to a plurality of light guides, the light guides being coupled to illuminate the switch.

APPLICATION SERIAL NO. 10/611,447

PATENT

Claim 29 (original): A device as recited in claim 28, wherein the light guides are associated with respective grooves on the switch.

Claim 30 (original): A device as recited in claim 28, wherein the unit comprises a laser diode array and the light guides include optical fibers coupled to respective emitters of the laser diode array.

Claim 31 (original): A device as recited in claim 1, wherein the switch comprises a beveled edge, light entering the switch in a direction substantially parallel to the switch axis and being totally internally reflected by the beveled edge into the switch.

Claims 32-88 (canceled)

Claim 89 (currently amended): A semiconductor switch for activation by light of a predetermined wavelength, comprising:

a first p-doped layer;

a first n-doped layer forming a switch blocking junction where in contact with the first p-doped layer, the switch blocking junction being substantially perpendicular to a switch axis;

a groove groove having a side wall, the side wall being disposed at least in the first n-doped layer and at a non-zero angle relative to the switch blocking junction and to the switch axis; and

means for refracting light absorbable by the switch at the side wall;

wherein the first n-doped layer and the first p-doped layer substantially lie within an absorption depth from the groove, the first n-doped layer and the first p-doped layer comprising a material having a band gap and the absorption depth being a function of the band gap and the wavelength of the light.

APPLICATION SERIAL NO. 10/611,447

PATENT

Claim 90 (previously presented): A switch as recited in claim 89 wherein the switch further comprises a beveled edge, light entering the switch being totally internally reflected by the beveled edge into the switch.

Claim 91 (previously presented): A switch as recited in claim 89, wherein the side wall extends from the first n-doped layer into the first p-doped layer.

Claim 92 (previously presented): A switch as recited in claim 89, wherein the first n-doped layer comprises a first sub-layer having a relatively high n-doping and ~~an a~~ second sub-layer having a relatively low n-doping, the switch blocking junction being formed between the second sub-layer and the first p-doped layer.

Claims 93-94 (canceled)

Claim 95 (previously presented): A device as recited in claim 1, wherein the groove terminates in the first n-doped layer away from the first p-doped layer.

Claims 96-99 (canceled)

Claim 100 (new): A light-activated semiconductor device comprising:
a plurality of switch sections, each of the switch sections comprising:
 a first p-doped layer;
 a first n-doped layer forming a main switch blocking junction with the first p-doped layer, the first n-doped layer and the first p-doped layer comprise material having a band gap; and
 a groove extending into at least a portion of the first n-doped layer from a side of the n-doped layer away from the switch blocking junction, at least a portion of the groove being a light refracting side wall disposed non-parallel and non-perpendicular to the switch blocking junction; and

APPLICATION SERIAL NO. 10/611,447

PATENT

a light pulse source optically coupled to each of the grooves of the switch sections, the light pulse source having a predetermined wavelength substantially matched to the band gap for substantially uniformly illuminating the first n-doped layer and the first p-doped layer of each of the switch sections.

Claim 101 (new): A light-activated semiconductor device as recited in claim 100, wherein the light source comprises light guides respectively disposed within the grooves of the switch sections.

Claim 102 (new): A light-activated semiconductor device as recited in claim 100, wherein the grooves of the switch sections comprise respective apertures for admitting light from the light source into the grooves.

Claim 103 (new): A light-activated semiconductor device as recited in claim 100, wherein the light source comprises light guides disposed in a plate, the light guides respectively being optically coupled to the grooves.

Claim 104 (new): A light-activated semiconductor device as recited in claim 100, further comprising:

**a plurality of additional switch sections having end bevels; and
means for illuminating the additional switch sections through the end bevels.**

Claim 105 (new): A light-activated semiconductor device as recited in claim 104, wherein the light source comprises light guides respectively disposed within the grooves of the switch sections and in proximity to the end bevels of the additional switch sections.

Claim 106 (new): A light-activated semiconductor device as recited in claim 104, wherein the switch sections and the additional switch sections comprise respective apertures for admitting light from the light source into the grooves and the end bevels.

APPLICATION SERIAL NO. 10/611,447

PATENT

Claim 107 (new): A light-activated semiconductor device as recited in claim 104, wherein the light source comprises light guides disposed in a plate, the light guides respectively being optically coupled to the grooves and the end bevels.

Claim 108 (new): A light-activated semiconductor device as recited in claim 100, wherein the grooves respectively extend through the first n-doped layers and the main switch blocking junctions into at least a portion of the first p-doped layers.

Claim 109 (new): A light-activated semiconductor device as recited in claim 100, wherein the grooves respectively terminate in the first n-doped layers away from the first p-doped layers.

Claim 110 (new): A light-activated semiconductor device as recited in claim 100, wherein each of the switch sections further comprises:

a first electrode layer disposed proximate the side of the first n-doped layer away from the switch blocking junction, the groove extending through the first electrode layer; and

a second electrode layer disposed proximate a side of the first p-doped layer opposite the switch blocking junction;

wherein a diode is formed.

Claim 111 (new): A light-activated semiconductor device as recited in claim 100, wherein the first n-doped layer comprises a n-buffer layer and an adjacent n-drift layer, the n-drift layer forming the blocking junction with the first p-doped layer, further comprising:

a first electrode layer disposed proximate the side of the first n-buffer layer opposite the switch blocking junction, the groove extending through the first electrode layer; and

a second electrode layer disposed proximate a side of the first p-doped layer opposite the switch blocking junction;

APPLICATION SERIAL NO. 10/611,447

PATENT

wherein a p-i-n diode is formed.

Claim 112 (new): A light-activated semiconductor device as recited in claim 100, wherein the first p-doped layer comprises a p-base layer and the first n-doped layer comprises an n-drift layer forming the blocking junction with the p-base layer, further comprising:

an anode layer disposed proximate the side of the n-drift layer away from the switch blocking junction, the groove extending through the anode layer;

a first electrode layer disposed proximate a side of the anode layer away from the switch blocking junction, the groove extending through the first electrode layer;

a cathode layer disposed proximate a side of the p-base layer away from the switch blocking junction; and

a second electrode layer disposed proximate a side of the cathode layer away from the switch blocking junction;

wherein a thyristor is formed.

Claim 113 (new): A light-activated semiconductor device as recited in claim 100, wherein the light pulse source comprises a diode-laser pumped solid state laser.

Claim 114 (new): A light-activated semiconductor device as recited in claim 100, wherein the light pulse source comprises a laser diode.

Claim 115 (new): A light-activated semiconductor device as recited in claim 100, wherein the light pulse source comprises a laser diode array.

Claim 116 (new): A light-activated semiconductor device as recited in claim 100, wherein:

the first n-doped layer and the first p-doped layer are formed in silicon having a band gap at about 1.1 eV; and

APPLICATION SERIAL NO. 10/611,447

PATENT

the wavelength of the light pulse source is in a range of about 1.06 um to about 1.2 um.